

# Understanding juvenile salmon movements and survival in the north Delta

## The “Clarksburg Bend” Pilot experiment

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US Geological Survey

# Team

3D tracking – USGS Columbia River Research Lab  
Survival modeling – Russ Perry, John Skalski (UW)  
Receiver placement, Surgery – Dave Vogel  
Hydrodynamics – Jon Bureau, Aaron Blake

# Acknowledgments

Lots of people: (Fish releases, Flow mapping, 3D tracking, network tracking)

Success depends on:  
(1) a workable plan and  
(2) solid execution

Today's talk will focus: on execution

No results yet:  
finished field work late last week

We are trying to move to less  
manpower intensive ways of  
conducting these studies

# Outline

(1) Study objectives

(2) Execution

(a) Mass-marked recapture  
(Brandes and Horn)

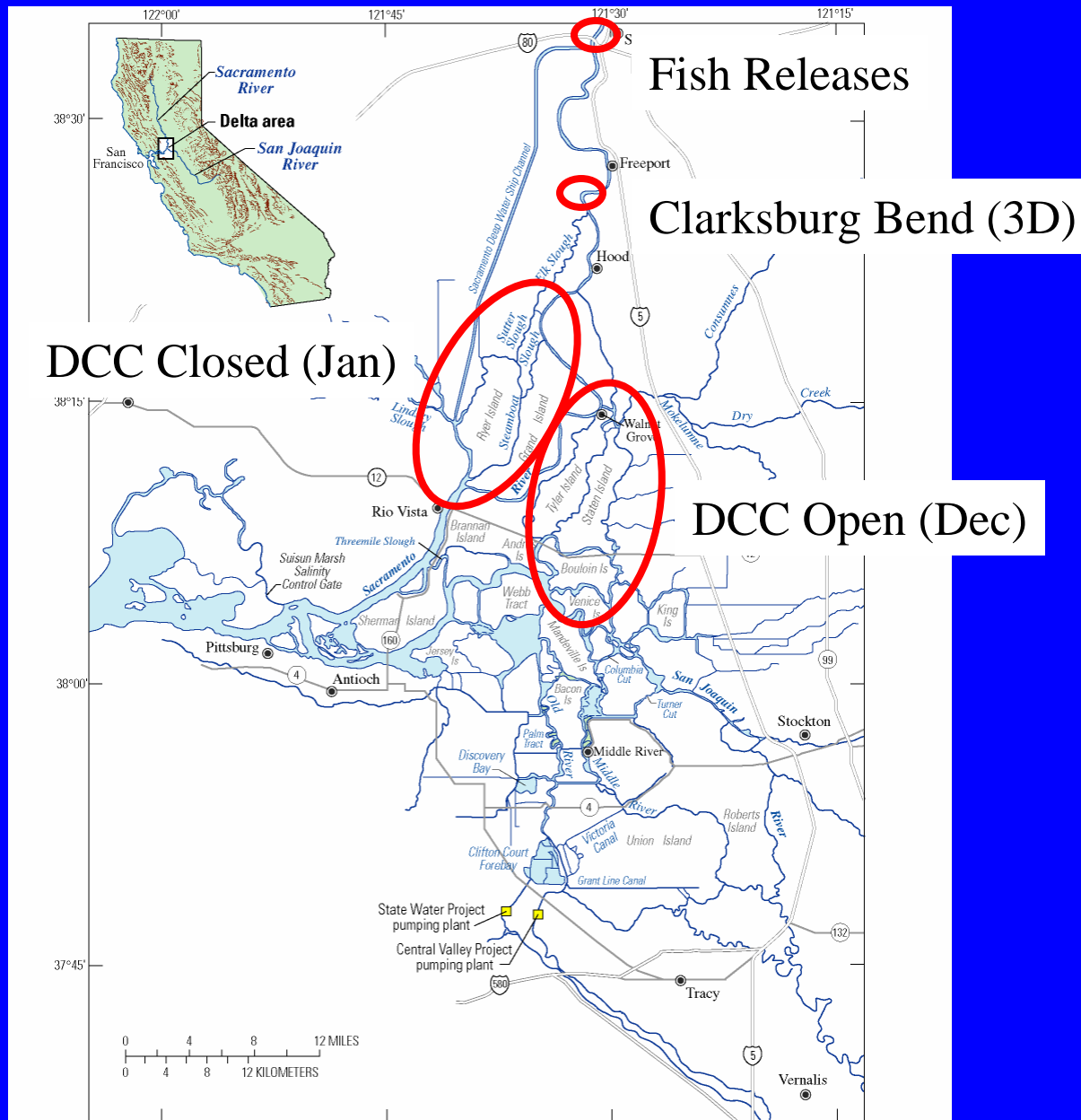
(b) Acoustic tag surgeries  
(Vogel)

(b) Acoustic tag releases  
(Bagheban and Goyal)

(c) 3D tracking in junctions  
(Blake and Bureau)

(d) tracking within the network  
(Vogel and Bureau)

# Map of where things happened



Location of flow station sites in the Delta Area of California.

## Timeline

Deploy 3d system at Clarksburg Bend

Deploy active acoustics at Clarksburg Bend

Install listening stations

Implant acoustic tags

Predict release times

Release mass-marked recapture fish (dates)

Release acoustic tag fish (dates)

(collect 3d and listening station data, flow  
network data, secondary circulation data)

Recover everything – done!

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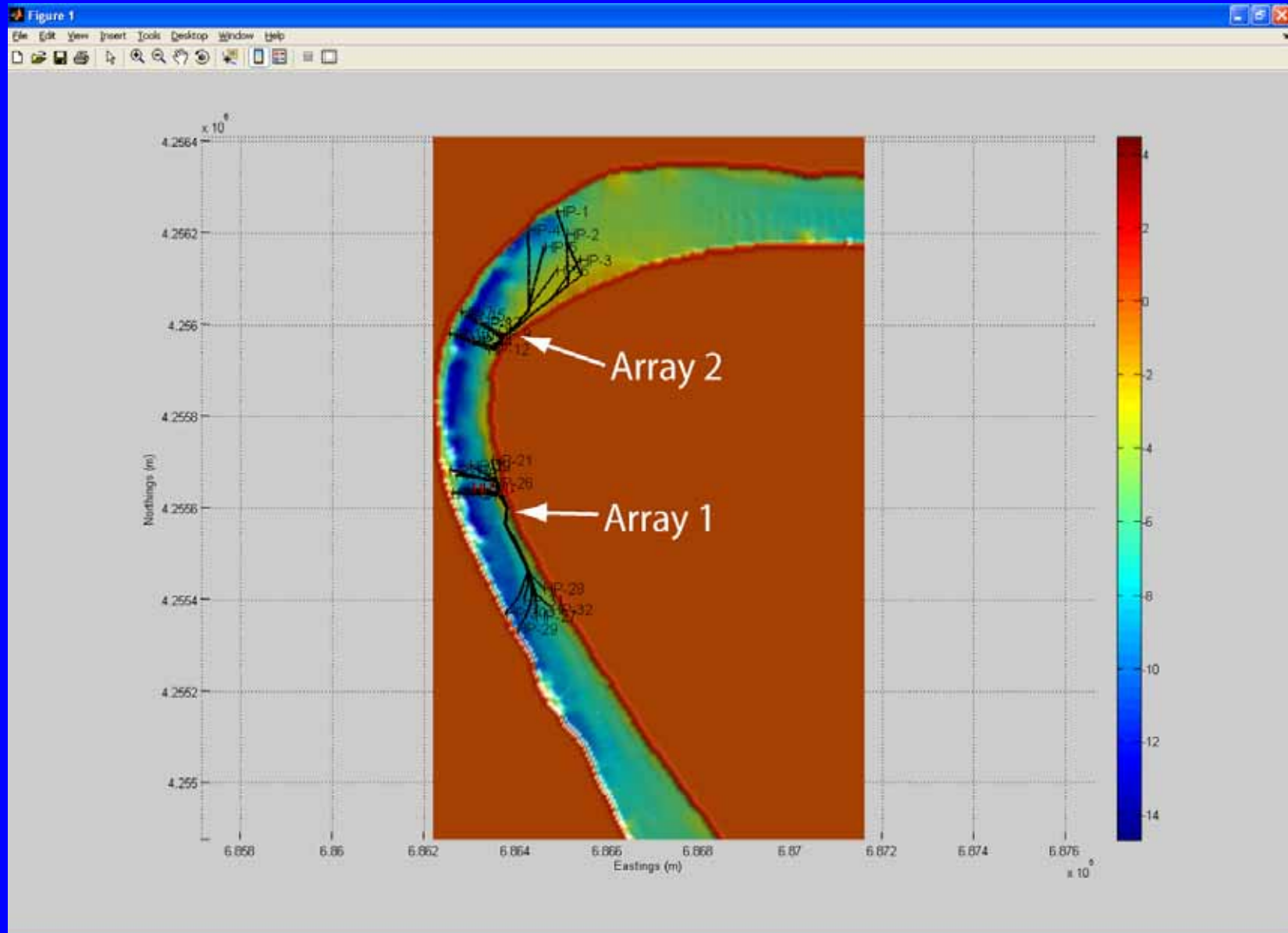
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## 3D Tracking of Acoustically-Tagged salmon in Clarksburg Bend

(~ 9 miles of cable, transducers needed to be placed with 2m accuracy)



## Cable recovery







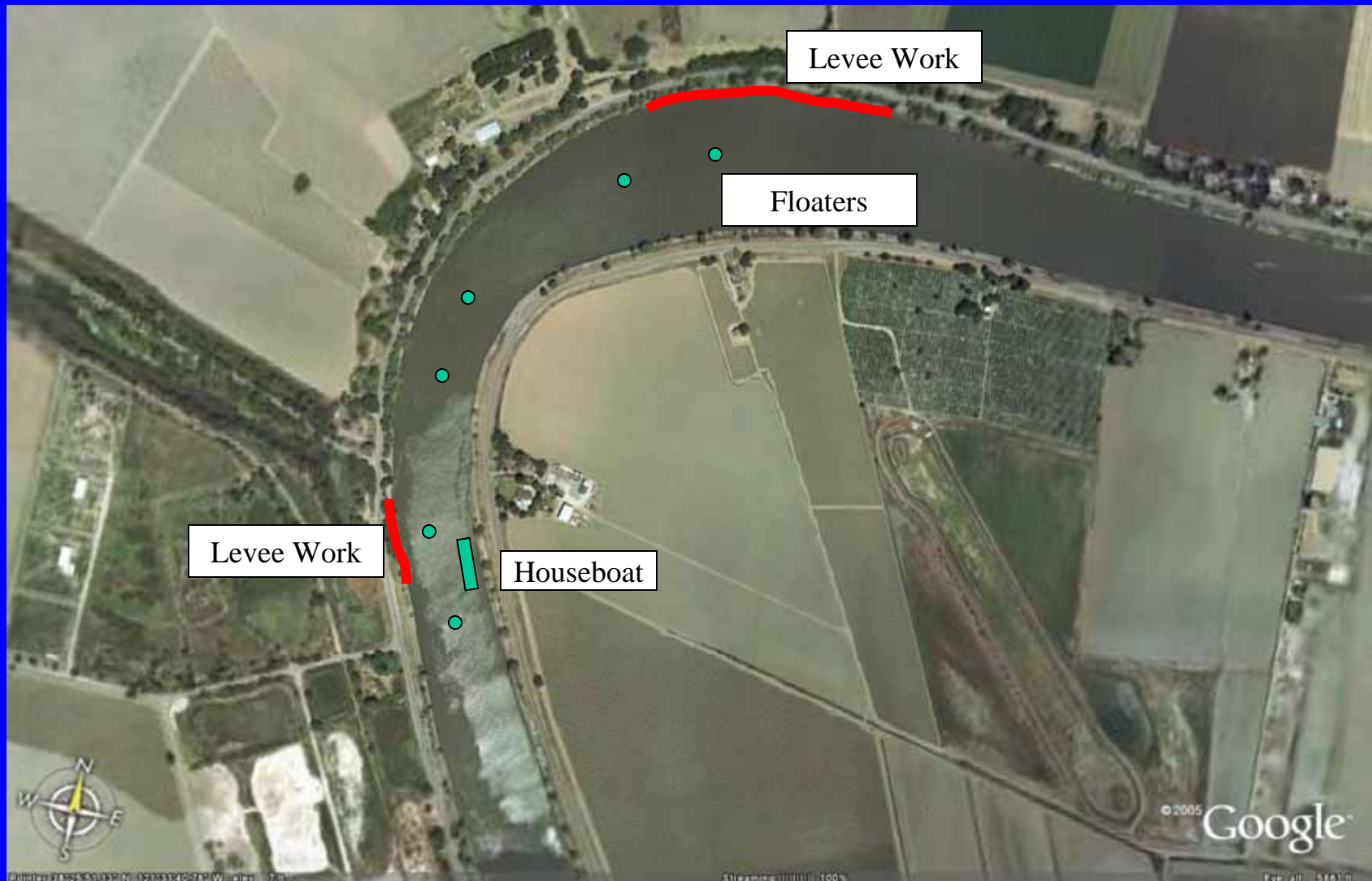




Reaction after 7 miles – 12,320 tie wraps



# Levee work made experiment difficult and dangerous





Barges used in levee work are very large (lots of inertia)

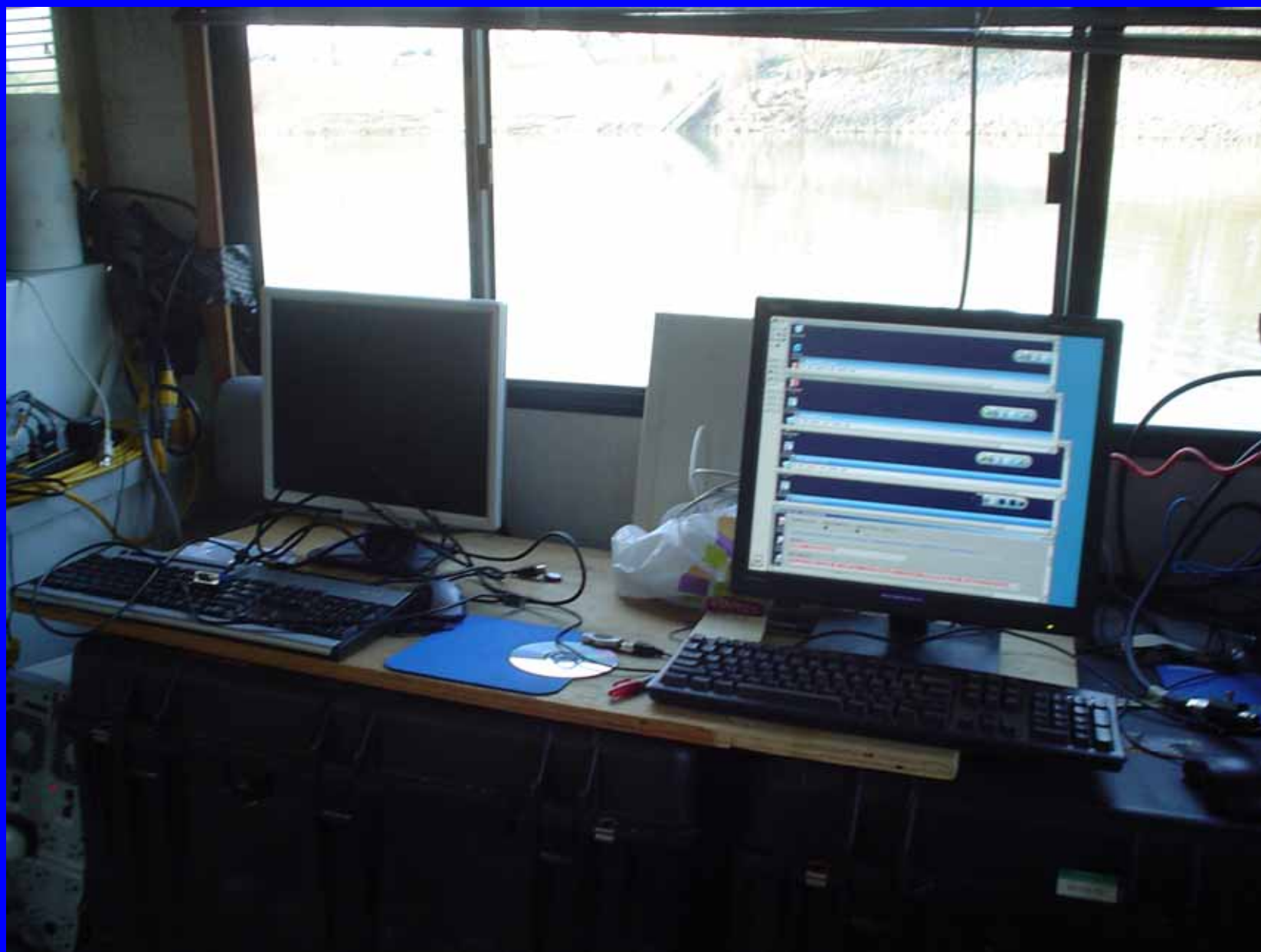


Work 24/6











## Remote 3D units

Generators needed  
fuel ~ 4hours





# RTK-GPS Buoy

RTK units needed to  
be removed for rock  
barges



## Contents

Laptop  
Hydrophone  
GPS unit  
Battery



Batteries  
needed  
changing ~  
6 hours

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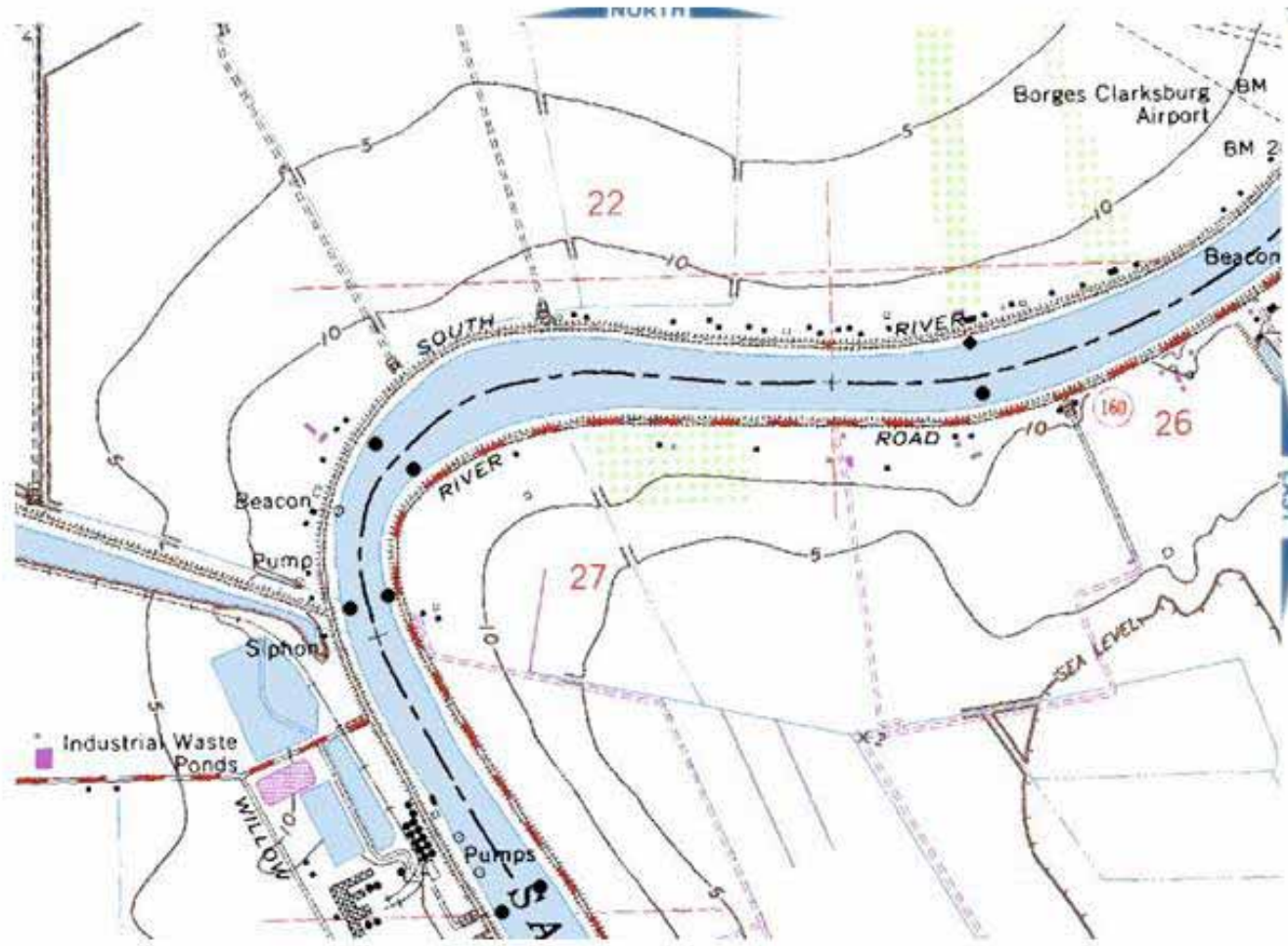
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# Active Transducer Locations



Courtesy of Horn



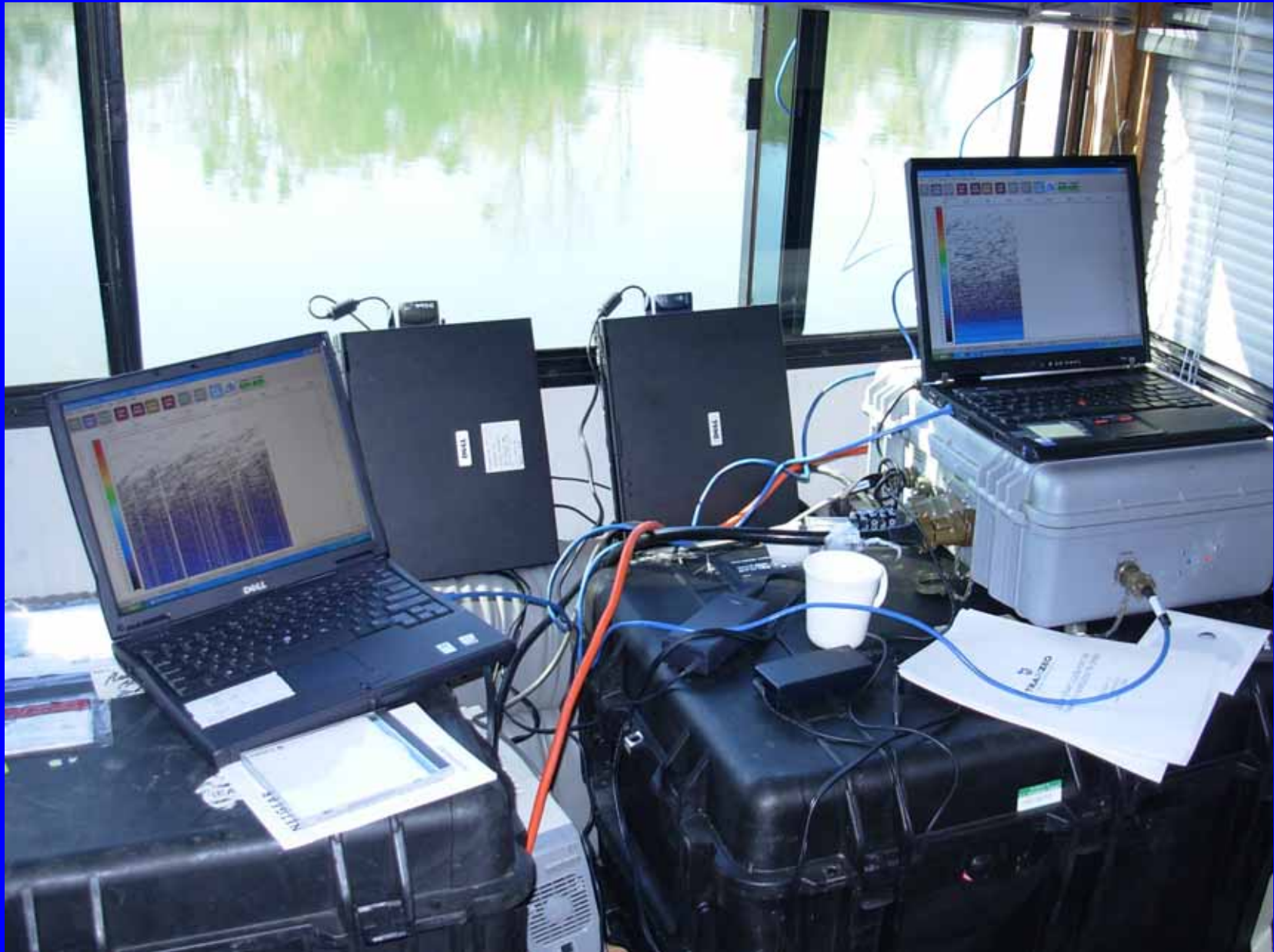
## Active Transducer



Courtesy of Horn



## Passive system Data Acquisition



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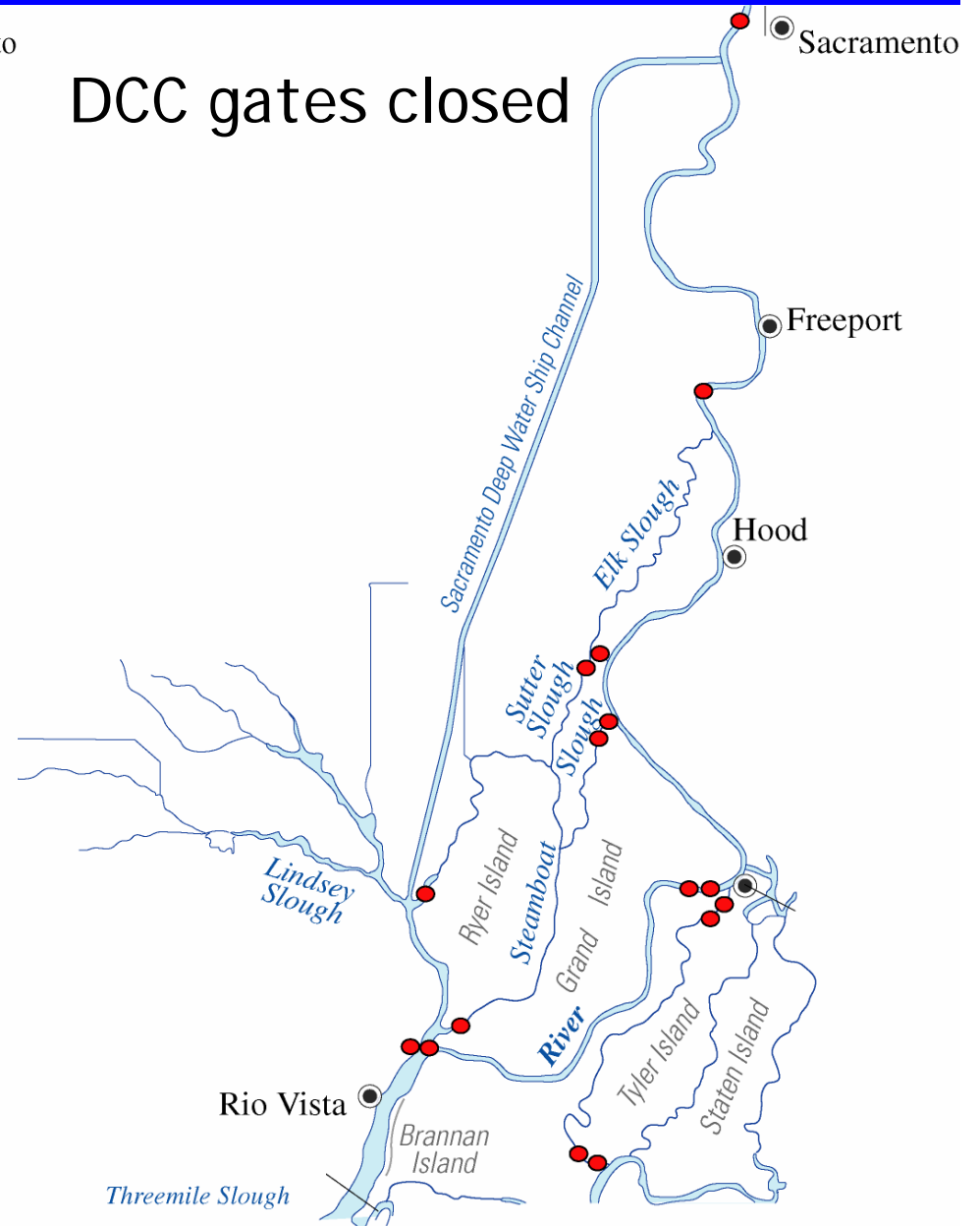
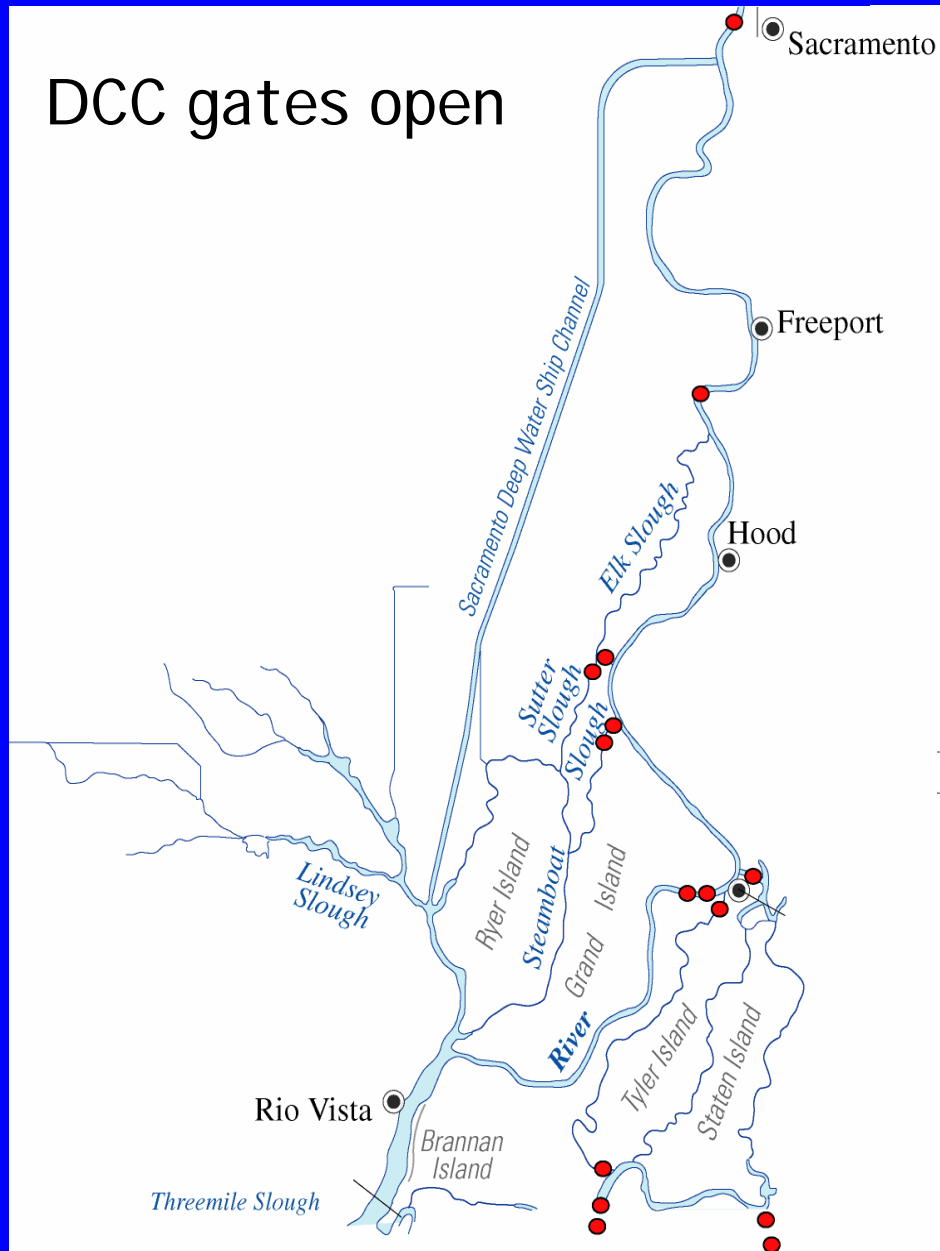
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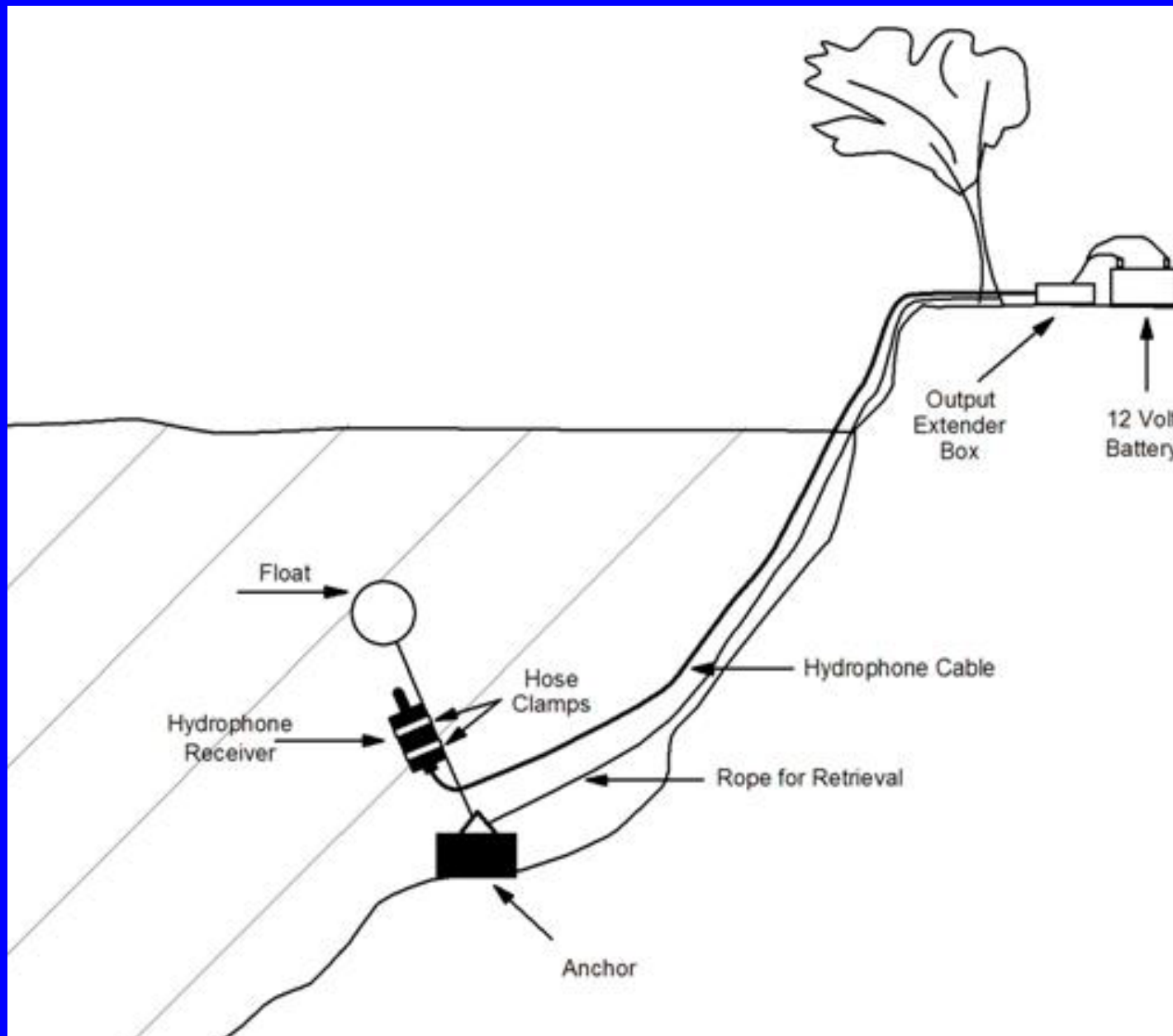
# Listening station locations

DCC gates open

DCC gates closed



# Installation schematic





**Acoustic Receiver**



## Lower Georgiana Slough installation





## Lower Georgiana Slough installation



## Cache Slough installation





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## 0.65 – Gram Acoustic Transmitter (Tag)



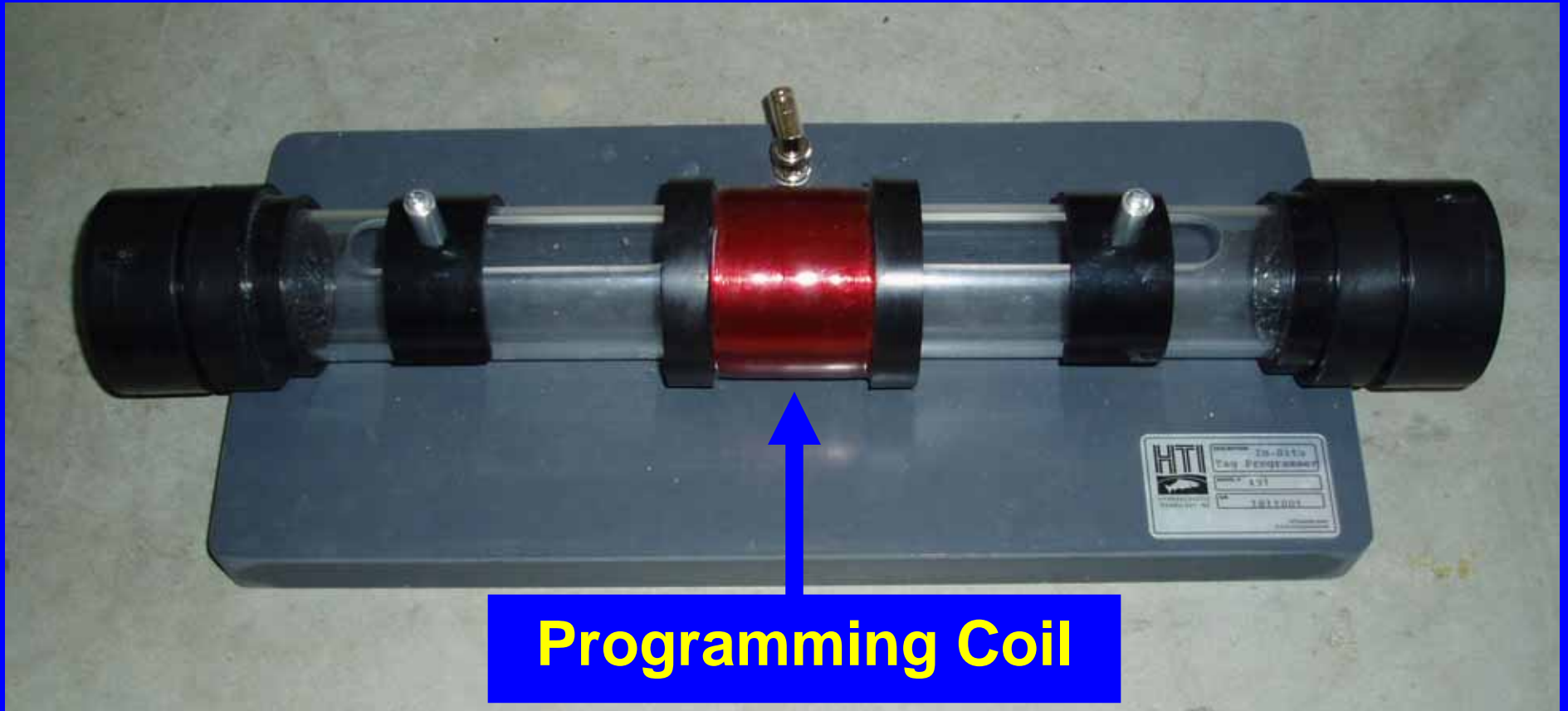
*Hydroacoustic Technology, Inc.*

Individually Identifiable Based on  
Programmed Pulse Width and  
Repetition Rate

## Fish surgeries (Vogel)



# *In Situ* Fish Tag Programmer



Activates Tag After Surgery and Extends Battery Life

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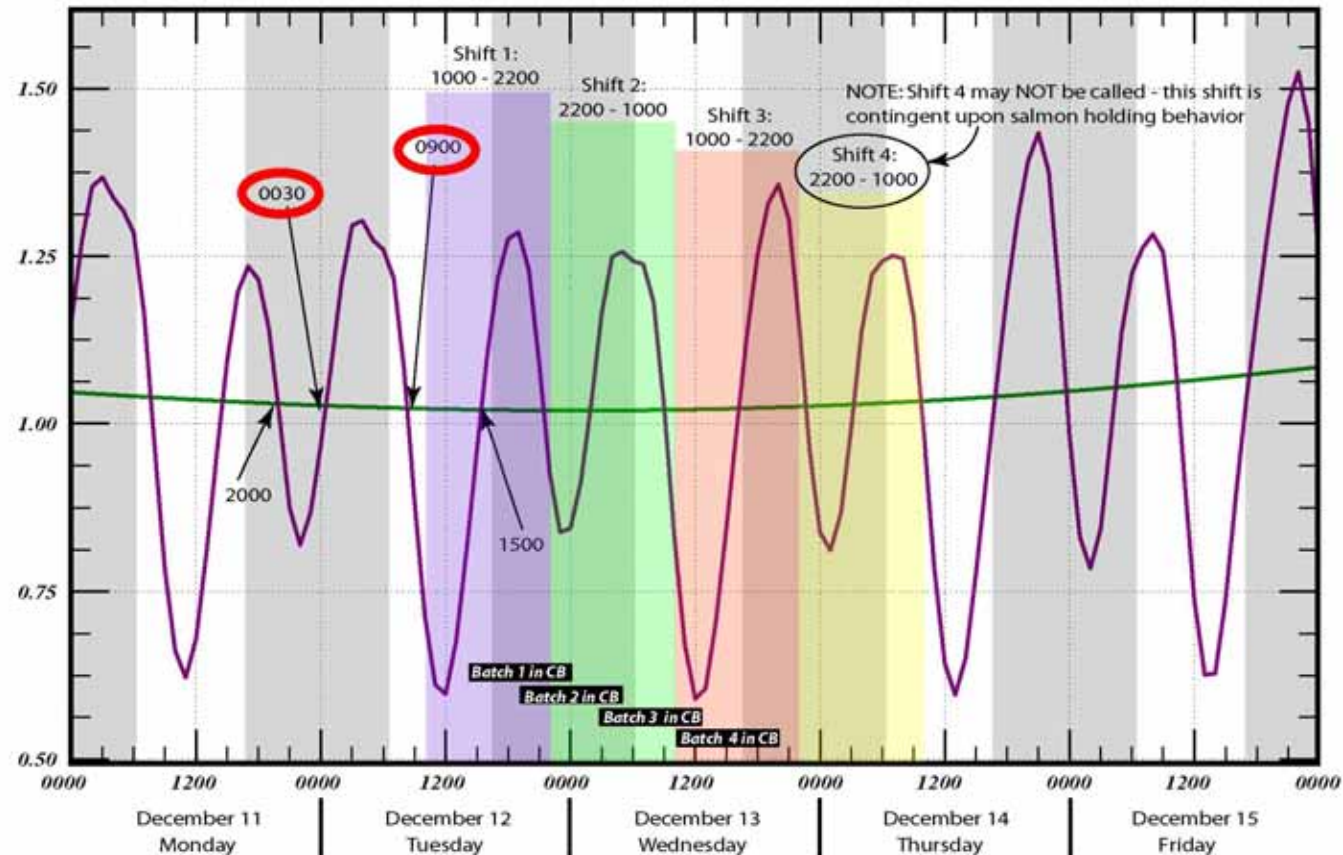
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# Harmonic Analysis Results used to time releases

Arrows / Times: Indicate Predicted Schedule for Fish release on Sacramento River (assume ~14 hour transit time)

Grey Boxes: Indicate estimated dark hours

Colored Boxes: Indicate estimated shift durations at CLARKSBURG BEND....shifts for fish watch / release are listed in text below



**NOTE SLIGHT CHANGES TO RELEASE SCHEDULE!!! Scheduled updated 12/11/2006, Cathy Ruhl**

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## Mass-released fish placed in pens



Courtesy of Cadrett



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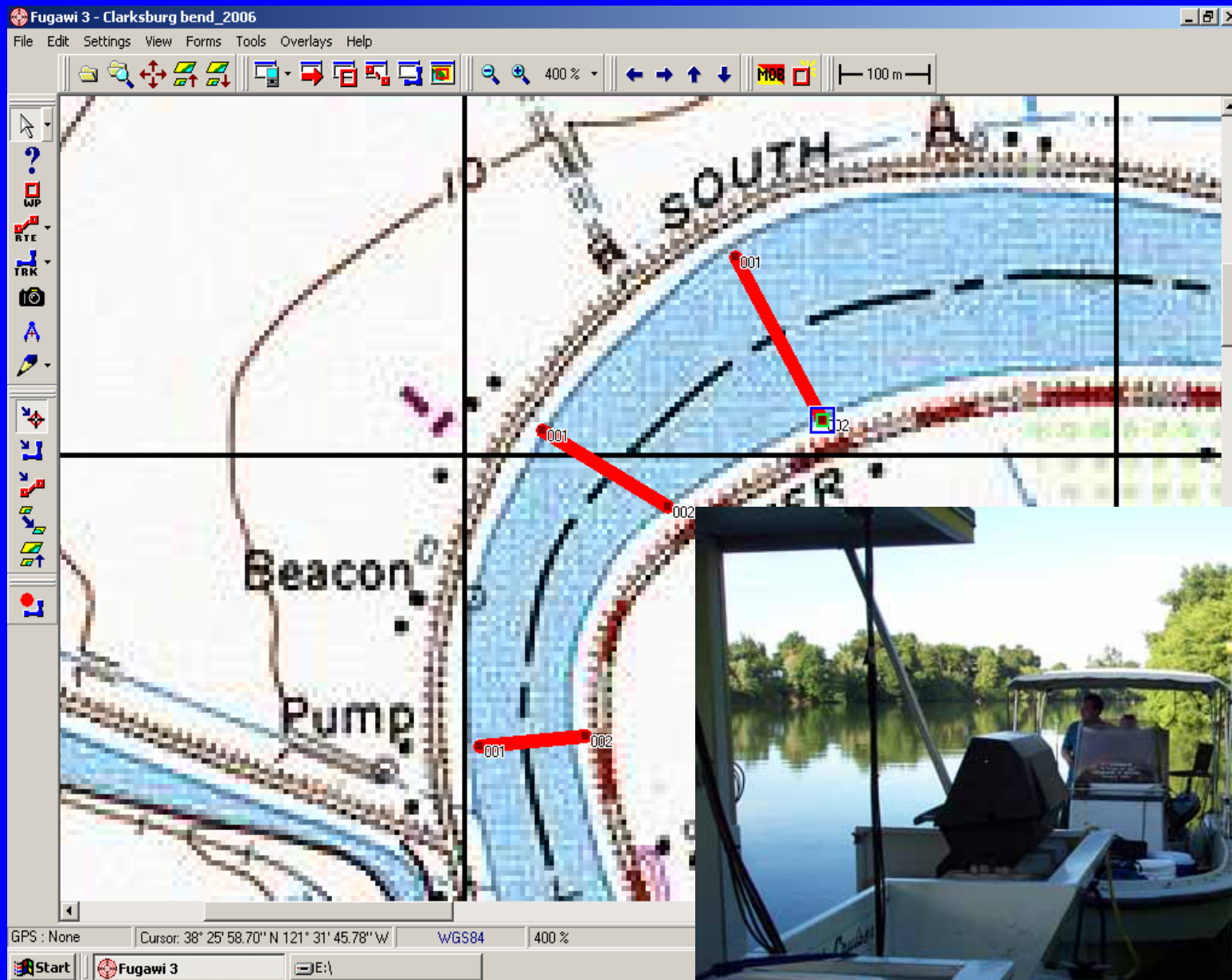
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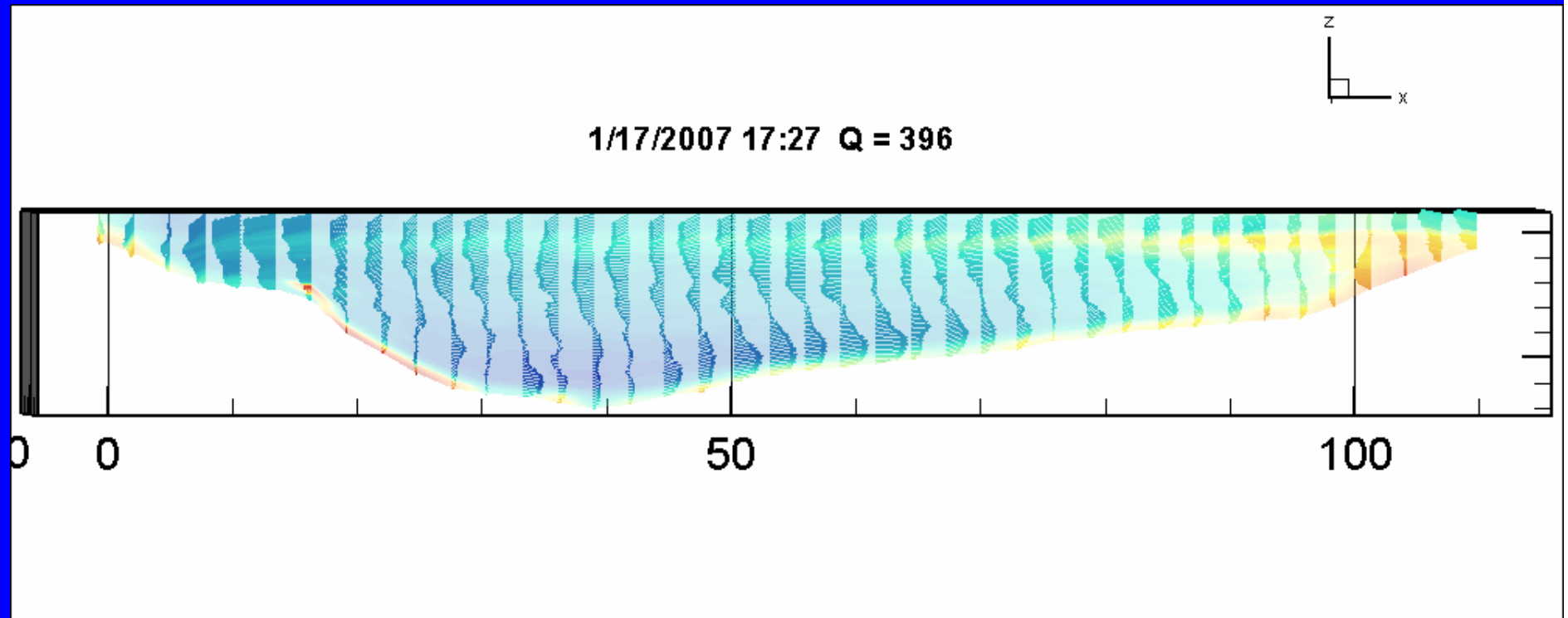
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# Mapping of secondary currents



## Secondary currents (section 3)





## Future of Mapping of secondary currents





